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Recovery Strategy Series

Recovery Strategy for the Grey Fox (*Urocyon cinereoargenteus*) in Canada

Grey Fox

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[1] http://sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1

Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996)[2] agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress five years after the publication of the final document on the SAR Public Registry.

The Minister of Environment and Climate Change is the competent minister under SARA for the Grey Fox and has prepared this recovery strategy, as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the Province of Ontario and the Province of Quebec, as per section 39(1) of SARA.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment and Climate Change Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Grey Fox and Canadian society as a whole.

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment and Climate Change Canada and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

The recovery strategy sets the strategic direction to arrest or reverse the decline of the species, including identification of critical habitat to the extent possible. It provides all Canadians with information to help take action on species conservation. When critical habitat is identified, either in a recovery strategy or an action plan, SARA requires that critical habitat then be protected.

In the case of critical habitat identified for terrestrial species including migratory birds SARA requires that critical habitat identified in a federally protected area[3] be described in the *Canada Gazette* within 90 days after the recovery strategy or action plan that identified the critical habitat is included in the public registry. A prohibition against destruction of critical habitat under ss. 58(1) will apply 90 days after the description of the critical habitat is published in the *Canada Gazette*.

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[2] http://registrelep-sararegistry.gc.ca/default.asp?lang=en&n=6B319869-1#2

[3] These federally protected areas are: a national park of Canada named and described in Schedule 1 to the *Canada National Parks Act*, The Rouge National Park established by the *Rouge National Urban Park Act*, a marine protected area under the *Oceans Act*, a migratory bird sanctuary under the *Migratory Bird Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* see ss. 58(2) of SARA.

For critical habitat located on other federal lands, the competent minister must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies.

If the critical habitat for a migratory bird is not within a federal protected area and is not on federal land, within the exclusive economic zone or on the continental shelf of Canada, the prohibition against destruction can only apply to those portions of the critical habitat that are habitat to which the *Migratory Birds Convention Act, 1994* applies as per SARA ss. 58(5.1) and ss. 58(5.2).

For any part of critical habitat located on non-federal lands, if the competent minister forms the opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of Parliament, or the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to prohibit destruction of critical habitat. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

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Executive Summary

The Grey Fox (*Urocyon cinereoargenteus*) is a medium sized mammal in the dog family and is found from southern Canada to northern Venezuela and Colombia. It is similar in size and appearance to the Red Fox (*Vulpes vulpes*), but has a stockier build and black tail tip in contrast to the Red Fox's white tail tip. The Grey Fox is the only canid[4] in North America that can climb trees, allowing it to hunt, den and rest in trees.

The Grey Fox is listed as Threatened on Schedule 1 of the federal *Species at Risk Act* (SARA). Prior to European contact, the Grey Fox is considered to have been "not an uncommon mammal" in southern Ontario, based on bones recovered from Indigenous settlements. However, it was extirpated at about the time of European contact, and was not reported again in Canada, until the 1890s. Since that time, Grey Foxes have been reported irregularly from Manitoba to New Brunswick. Most records are considered to be non-breeding (not mature) individuals, dispersing in search of new territories, but there are two known Canadian sub-populations: on Pelee Island in Lake Erie (breeding confirmed); and in northwestern Ontario (Rainy River District east to Dorian, breeding evidence). In addition there is weak evidence of breeding in southern Quebec. The reappearance of the Grey Fox in Canada over the last century is thought to be entirely due to natural dispersal of Grey Foxes from the U.S.. Population data is lacking for this species, but the Canadian population is estimated to contain fewer than 110 mature individuals.

The most significant threat facing the Grey Fox in Canada is hunting and trapping. Grey Foxes are incidentally captured and sometimes killed during legal trapping activities targeted at other species. Due to lack of good population data, the impact of this source of mortality on the population is difficult to assess, but it is rated as a high level threat because it has the potential to limit the natural establishment of new breeding populations of Grey Foxes in Canada. The impact of disease and road mortality on the Grey Fox in Canada is unknown.

The recovery of the Grey Fox is considered feasible. The population and distribution objectives for Grey Fox are to 1) maintain the sub-population on Pelee Island, 2) maintain the northwestern Ontario sub-population and support natural increase of abundance and distribution in this region, and 3) maintain the current distribution of Grey Fox in Canada and support natural establishment and expansion of any newly identified or newly established sub-populations of Grey Fox in Canada. Broad strategies to be taken to address the threats to the survival and recovery of the species are presented in the section on Strategic Direction for Recovery (Section 6.2).

Critical habitat for the Grey Fox is partially identified in this recovery strategy, based on the best available data. A schedule of studies is included to obtain the information needed to complete the identification of critical habitat. As more information becomes

[4] Any animal of the dog family, Canidae, including the wolves, jackals, coyotes, foxes and domestic dogs.

available, additional critical habitat may be identified where critical habitat criteria are met.

One or more action plans for the Grey Fox will be posted on the Species at Risk Public Registry by December 31, 2025.

Recovery Feasibility Summary

Based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility, there are unknowns regarding the feasibility of recovery of the Grey Fox. In keeping with the precautionary principle, this recovery strategy has been prepared as per section 41(1) of SARA, as would be done when recovery is determined to be technically and biologically feasible. This recovery strategy addresses the unknowns surrounding the feasibility of recovery.

1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.

Yes. Pelee Island in Lake Erie contains the only verified breeding sub-population[5] of Grey Foxes in Canada. The Pelee Island sub-population is thought to be stable with fewer than 60 mature individuals (COSEWIC 2015b). There is also evidence for a breeding sub-population in northwestern Ontario stretching from the Rainy River District to Thunder Bay (Van den Broeck 2014a; Van den Broeck pers. comm. 2015; COSEWIC 2015b). The northwestern Ontario sub-population is estimated to contain fewer than 50 mature individuals (Van den Broeck 2014a; Van den Broeck pers. comm. 2015; COSEWIC 2015b), and is thought to be currently connected to the adjacent U.S. population by dispersal (Van den Broeck 2014a; COSEWIC 2015b). In addition there are records of mature individuals and weak evidence of breeding in southern Quebec. Recent Grey Fox records in Manitoba and New Brunswick are likely to be sub-adults dispersing from the adjacent U.S. population, and there is currently no evidence of breeding in these regions (COSEWIC 2015b). Most Grey Fox populations in the northeastern U.S. appear to be stable or increasing (except in Ohio), and several are showing a northward range expansion (Minnesota, Wisconsin and Maine) (COSEWIC 2015b). Therefore, these populations are likely to provide a continuing source of individuals adapted to a climate similar to the Canadian range (Judge and Haviernick 2002; COSEWIC 2015b).

2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.

Yes. The forest and mix of forest and open areas that Grey Foxes are thought to prefer is widely available in northwestern Ontario (Ontario Partners in Flight 2008), and is likely to be available in southern Quebec and southwestern New Brunswick (COSEWIC 2015b), where records have been increasing in recent years. Pelee Island has approximately 20% forest cover (Essex Region Conservation Authority 2015), and most of the larger forest patches are contained within protected areas. Therefore Grey Fox habitat on Pelee Island is likely stable, and habitat restoration or creation should be

[5] Geographically or otherwise distinct groups in the Canadian population between which there is little demographic or genetic exchange (COSEWIC 2015a). The two Canadian sub-populations (Pelee Island and northwestern Ontario were identified by COSEWIC (2015b).

feasible if necessary. However, due to the Grey Fox's preference for forested habitat, landscapes throughout the rest of the range of the Grey Fox in southern Ontario with low forest cover may not provide optimal habitat (COSEWIC 2015b).

3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.

Unknown. Hunting and trapping is the only threat with a high level of impact under the threat assessment for this species. Grey Foxes are incidentally captured and sometimes killed as by-catch[6] during legal trapping activities targeting other species. Due to lack of good population data, the impact of this source of mortality is difficult to assess at the population level, but it is rated as a high level threat because it has the potential to limit the natural establishment of new breeding populations of the Grey Fox in Canada. Since Grey Foxes are not targeted directly by trappers, but are instead captured as by-catch in traps targeting other species, avoiding or mitigating this threat will be difficult, as it is difficult to modify traps to exclude Grey Foxes while still capturing targeted species such as Coyotes (*Canis latrans*) and Red Foxes (*Vulpes vulpes*). The Grey Fox also face threats from road mortality and disease (especially canine distemper and rabies). If necessary, mitigation of road mortality and measures to reduce the spread of infectious disease (such as vaccination (Woodroofe et al. 2004), or restricting presence of stray domestic animals in natural areas), are possible.

4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.

Yes. Given the natural expansion of the Grey Fox in Canada since the 1890s, the recent increase in records in northwestern Ontario and southern Quebec, and the mostly stable or increasing sub-populations in the northeastern U.S. (COSEWIC 2015b), the continued natural increase in abundance and distribution of the Grey Fox in Canada is considered likely, despite the continuing risk of incidental take through by-catch during legal trapping, road mortality and infectious disease. This recolonization will rely on continued connectivity with U.S. populations, which may require long-term, landscape level land use planning, and forest conservation and stewardship to maintain connections with the U.S. population.

As the small Canadian population of the Grey Fox occurs at the northern edge of its continental range, and the vast majority of its continental distribution and population occurs further south in the U.S., it is important to note that population changes at the continental level may have a significant effect on recovery feasibility in Canada. Grey Fox population size and trends are difficult to measure due to its secretive, mobile and nocturnal behavior. However, if the continental population of Grey Fox experiences an ongoing downward or upward population trend, its range may correspondingly contract towards the center of its range or expand near the periphery. In these cases, the rate of recovery of the Canadian population, and the rate of achievement of population and

[6] Incidental capture of non-target species.

distribution objectives, may reflect both these continental range changes and local response to the provision of suitable habitat and mitigation of key threats. Given the northward expansion of the Grey Fox's range during the 20th century, and the potential for climate change to improve conditions for Grey Fox survival in Canada (COSEWIC 2015b), the rate of recovery of the Canadian population of Grey Fox and rate of achievement of population and distribution objectives may exceed those anticipated here.

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1. COSEWIC* Species Assessment Information

Date of Assessment: November 2015

Common Name (population): Gray Fox**

Scientific Name: *Urocyon cinereoargenteus*

COSEWIC Status: Threatened

Reason for Designation: This southern fox is apparently expanding northward, but very few mature, breeding individuals are known to live in Canada. These animals are restricted to two sub-populations; one in the Rainy River – Thunder Bay region, which has a strong rescue effect, but rescue effect for the other, Pelee Island, is uncertain. Sub-population threats include incidental trapping and roadkill. Animals have been recorded in Manitoba and Quebec, but breeding is not evident at this time. Recent records in New Brunswick likely represent dispersing non-breeding animals.

Canadian Occurrence: Ontario

COSEWIC Status History: Designated Special Concern in April 1979. Status re-examined and designated Threatened in May 2002 and November 2015.

* COSEWIC – Committee on the Status of Endangered Wildlife in Canada

** The species is listed under SARA as the "Grey Fox", but is commonly referred to as "Gray Fox" (COSSARO 2016).

2. Species Status Information

The Grey Fox (*Urocyon cinereoargenteus*) is listed as Threatened[7] on Schedule 1 of the federal *Species at Risk Act* (SARA). It is also listed as Threatened[8] in Ontario under the provincial *Endangered Species Act, 2007* (ESA), which automatically results in general habitat protection for the Grey Fox in Ontario. Ontario designates it as a Furbearing Mammal under the Ontario *Fish and Wildlife Conservation Act* (S.O. 1997). In Quebec the Grey Fox is considered an occasional resident and therefore has no status under the Quebec *Act Respecting Threatened or Vulnerable Species* (LEMV) and is not listed on the list of species likely to be designated Threatened or Vulnerable under LEMV. Quebec lists the Grey Fox as a Fur Bearer under the Regulation Respecting Trapping and the Fur Trade (CQLR c C61.1, r21), although trapping is currently prohibited, and any animal found accidentally injured, captured, or killed must be set free (if unharmed and alive) or declared and delivered to a wildlife protection officer (if wounded or dead)

[7] A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.

[8] A species that lives in the wild in Ontario, is not endangered, but is likely to become endangered if steps are not taken to address factors threatening to lead to its extinction or extirpation.

(Ministère des Forêts, de la Faune et des Parcs 2014). The Grey Fox is not considered to be a breeding resident in Manitoba (COSEWIC 2015b) and is considered accidental/transient in New Brunswick (Atlantic Canada Conservation Data Centre 2014). The International Union for Conservation of Nature (IUCN) lists global status of the Grey Fox as Least Concern[9] (Cypher et al. 2008). The conservation status of the Grey Fox throughout its North American range is described in Appendix A.

3. Species Information

3.1 Species Description

The Grey Fox is a medium sized mammal in the dog family, with an average total length of 82.5 to 113.0 cm (Naughton 2012). The tail makes up roughly one-third of the total length (Aldridge 2008). Grey Foxes are similar in size and appearance to Red Foxes, but seem smaller due to their shorter leg length and stockier appearance (Cypher 2003). The coat has a peppered look with different shades of grey and reddish brown highlights on neck, sides and legs. The underside is lighter with a cinnamon-like appearance. White or tan fur appears on the throat, face, chest, belly, hind legs and ears, with black tufts of hair on the top of the ears (Judge and Haviernick 2002; Aldridge 2008; Naughton 2012). Key characteristics that distinguish Grey Foxes from the Red Foxes include: a dark stripe running the length of the back to the end of the tail (Red Foxes do not have a stripe, and have a white tail tip), a black muzzle patch in front of each eye on the lower jaw (Red Foxes do not have this patch), and differences in tracks (broader, rounder, closer together with claws more curved than Red Fox) and skull characteristics (a U-shaped crest on the back of the skull and simple single lobed incisors, compared to the lack of U shaped crest and lobed incisors of Red Foxes) (Judge and Haviernick 2002; Aldridge 2008; Naughton 2012).

The Grey Fox is the only canid[10] in North America that can climb trees, allowing it to hunt, den and rest in trees (Whitaker 1998; Naughton 2012). Adaptations that aid this behaviour include the Grey Fox's short legs, long, sharp non-retractable recurved claws and its ability to rotate the forelegs more than other canids (Aldridge 2008). The Grey Fox is thought to be crepuscular[11] and nocturnal[12] (Fritzell and Haroldson 1982). For example, during a year-long study on Pelee Island using motion cameras to detect Grey Foxes, the majority of records were at night (Bowman et al. 2013). Grey Foxes become sexually mature at approximately 10 months, and are expected to live up to 4-5 years (based on data from populations subject to trapping mortality, COSEWIC 2015b).

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[9] A taxon is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

[10] Any animal of the dog family Canidae, including the wolves, jackals, hyenas, coyotes, foxes and domestic dogs.

[11] Active during twilight.

[12] Active during night time.

COSEWIC recognizes a single designatable unit for the Grey Fox in Canada, based on lack of genetic structuring in eastern populations of Grey Fox (COSEWIC 2015b). However, there has been no genetic work on Grey Foxes in Canada. Recent research suggests that there is a fairly strong genetic divergence between Grey Foxes found in California (representing southwestern populations), and those found in Georgia (representing southeastern populations), based on mitochondrial DNA[13] (Goddard et al. 2015). While southeastern and southwestern populations show genetic divergence similar to those between other canid species (e.g. amount of genetic divergence between southeastern and southwestern Grey Fox populations is estimated as >162% of the divergence between Kit Fox, *Vulpes macrotis*, and Swift Fox, *Vulpes velox*), more research is needed to confirm these findings (Goddard et al. 2015). The Canadian population of the Grey Fox is hypothesized to result from the post-glacial expansion of the southeastern population (Goddard et al. 2015) and there is no evidence that animals from the southwestern populations have entered Canada (COSEWIC 2015b).

3.2 Species Population and Distribution

Grey Foxes are found from southern Canada to northern Venezuela and Colombia (NatureServe 2015; COSEWIC 2015b) (Figure 1). Despite being unreported from Canada post-European contact until the 1890s, records of Grey Foxes in Canada have steadily increased since that time, and COSEWIC (2015b) identified two sub-populations of Grey Foxes in Ontario (Pelee Island and northwestern Ontario). In addition, there is weak evidence of Grey Foxes breeding in Quebec. Grey Foxes have also been reported from Manitoba and New Brunswick, but there is currently no evidence of breeding in these areas (COSEWIC 2015b). The reappearance of Grey Foxes in Canada is thought to be entirely due to natural immigration of Grey Foxes from the U.S. (Judge and Haviernick 2002).

Prior to European contact, Grey Foxes are thought to have been "not an uncommon mammal" (Downing 1946) in southern Ontario, almost as common as Red Fox based on bones found at Indigenous settlements (Downing 1946; COSEWIC 2015b). However, Grey Foxes were extirpated from Canada around the time of European contact and were not reported again until the 1890s (Anderson 1939; Downing 1946). The reasons for extirpation are unclear. It is possible that European settlers played a role in reducing numbers of Grey Foxes (for example through clearing of forest or through trapping). However, given the interest which its tree-climbing ability would have provided to early observers, the absence of Grey Foxes from the written records of early settlers suggest they were already rare or absent when settlers arrived (Downing 1946). Another hypothesis is that extirpation could have been due to cooler temperatures during the Little Ice Age (1500-1850), leading to Grey Foxes disappearing from the northern parts of its range in Canada and northeastern U.S. (Bozarth et al. 2011; COSEWIC 2015b).

[13] The DNA located in mitochondria, comprised of 37 genes. Mitochondrial DNA is inherited only maternally.

During the 20th Century, the range and abundance of Grey Foxes expanded in the northeastern U.S., probably in response to warming temperatures, and reforestation associated with farmland abandonment (Downing 1946; Fritzell and Haroldson 1982; Bozarth et al. 2011; COSEWIC 2015b). Grey Foxes are present in all states that border Ontario, Quebec and New Brunswick, and in recent years the range of the Grey Fox has been expanding northward in Minnesota, Wisconsin and Maine (McAlpine et al. 2008; Latimer 2014; COSEWIC 2015b). Grey Fox populations are thought to be increasing in Vermont and stable in Michigan, New Hampshire and New York (COSEWIC 2015b). However, populations in Ohio have shown a decreasing trend since the 1990s, although the trend appears to have stabilized in recent years (OHDNR 2014).

The first modern reports of Grey Foxes in Canada come from southern Quebec in the 1890s (Anderson 1939) and southern Ontario in the 1940s (Downing 1946). Since the 1940s, there have been approximately 160 confirmed records of Grey Foxes in Canada, mostly in southern Ontario, including Pelee Island, but also from the rest of Ontario, Manitoba, Quebec and New Brunswick (Figure 2). Many of these animals are thought to be young, non-breeding individuals dispersing from their birth place in search of new territories (COSEWIC 2015b).

The only region in Canada where Grey Fox breeding has been confirmed is Pelee Island in Lake Erie (COSEWIC 2015b). Grey Foxes were first recorded on Pelee Island in 1983, and the current Pelee Island sub-population is estimated to be less than 60 mature individuals (COSEWIC 2015b). There is recent, direct evidence that Grey Foxes breed on Pelee Island, and the population size on the island is thought to be stable (COSEWIC 2015b). However, it is unclear if individual Grey Foxes travel between Pelee Island and adjacent populations in Ohio, New York or Michigan (COSEWIC 2015b).

There is also a sub-population in northwestern Ontario (COSEWIC 2015b). Grey Foxes were first recorded in this region in 1944, and there were seven confirmed records between 1944 and 2005 (Van den Broeck 2014a). Since 2005, records have increased steadily, with 19 confirmed records between 2006 and 2015. The majority of confirmed records are from the winter (December – February). As evidence of breeding in this region has only been reported in the last few years (see below), it is likely that many of these individuals were juveniles dispersing from the U.S. Records of Grey Fox in northeastern Minnesota have also increased over the last decade (COSEWIC 2015b), suggesting the increase in Grey Foxes in northwestern Ontario is part of a larger range expansion in the region, and possibly suggesting the existence of a cross-border population.

Although breeding has not been fully confirmed in northwestern Ontario, evidence of breeding in this region has been collected over the last several years including: a possible family group observed near Thunder Bay (2013); a pair of Grey Foxes hit by a vehicle near Rainy River during the mating season (2014); and a photograph of a lactating female taken near Thunder Bay (2015) (Van den Broeck 2014 a,b; Van den

Broeck, pers. comm. 2015). The northwestern Ontario sub-population is estimated to contain less than 50 mature individuals (COSEWIC 2015b).

Elsewhere in Ontario, there have been irregular records of Grey Foxes along the north shore of Lake Erie northeast to Lake Huron, and along the northeastern shore of Lake Ontario and the St. Lawrence River (Figure 2). There have been no confirmed records in the former area since 2002, but Grey Foxes have been reported irregularly from eastern Ontario in the last 10 years, including a road-killed Grey Fox collected from the St. Lawrence Islands Parkway in 2008 (COSEWIC 2015b). There is one breeding record from Leeds, Grenville, Stormont, Dundas and Glengarry counties from the 1950s (cited in Peterson et al. 1953), but no breeding evidence is available since that time. Animals throughout both areas are considered to be non-breeding individuals and presently are not part of an established breeding population (COSEWIC 2015b).

In southern Quebec, records of Grey Foxes have increased in recent years, with 45 records since the 1890s of which 36 have occurred since 2003, including six animals incidentally trapped in winter 2015-2016 Dalpé-Charron pers. comm 2016). Most of the records are within 50 km of known or suspected breeding populations in the U.S., and could be considered as part of a possible cross-border population. However, in winter 2015-2016, a female Grey Fox was incidentally captured in the Lanaudiere region of Quebec (Dalpé-Charron pers. comm 2016). This is the first known record north of the St. Lawrence River in Quebec, and is approximately 170 km north of the US border, and 130 km north of the previously most northerly record of Grey Fox in Quebec (Figure 2), providing evidence of a northward range expansion in Quebec. There is no direct evidence of breeding in this region (e.g. no lactating females or kits reported, COSEWIC 2015b), although two recent records provide weak evidence of breeding. Firstly, in December 2011, a juvenile female was killed on a road near Sherbrooke (Dalpé-Charron pers. comm 2016). The animal could either have been born in Quebec, or dispersed into Quebec from Vermont in the previous few months (COSEWIC 2015b). Secondly, in winter 2015-2016, a female incidentally captured in the Monteregie region was autopsied and found to have placental scars[14] (Dalpé-Charron pers. comm 2016), an indication that this was an adult with a previous pregnancy (Lindström 1981). This record is very close to the U.S. border and could indicate that the animal bred in Quebec. Alternatively, the animal could have moved into Quebec from the U.S. after breeding, either because it has a trans-boundary territory or because it dispersed into Quebec after breeding (e.g. adult female Grey Foxes sometimes disperse after losing a mate, Chamberlain and Leopold 2002).

Grey Fox records from Manitoba and New Brunswick are not considered to be part of established breeding populations. Irregular records in southeastern Manitoba are considered to be animals moving from U.S. populations, and the Manitoba government does not consider the Grey Fox to be a breeding resident of the province (COSEWIC 2015b). There are two records of individual Grey Foxes in New Brunswick from 2007 and 2014. Each record was more than 130 km from the nearest Grey Fox records in

[14] A scar or pigmented area of the uterus, marking site of previous attachment of a placenta in mammals.

Maine (McAlpine et al. 2008; McAlpine et al. 2016). Both animals are believed to have dispersed from Maine into New Brunswick (COSEWIC 2015b). A single record near Lake Athabasca in Alberta is considered to be a vagrant and is not considered as part of the Canadian range (COSEWIC 2015b).

Population data on the Grey Fox is lacking throughout its global range including Canada (Cypher 2003; Aldridge 2008). Although there have not been any population studies conducted on the Grey Foxes in Canada, COSEWIC (2015b) estimates the Canadian population to be fewer than 110 mature individuals. The Grey Fox is at the northern edge of its range in Canada, and changes in population size and distribution are likely to be closely linked to changes in adjacent U.S. populations (COSEWIC 2015b).

Figure 1. Global range of the Grey Fox (Judge and Haviernick 2002).

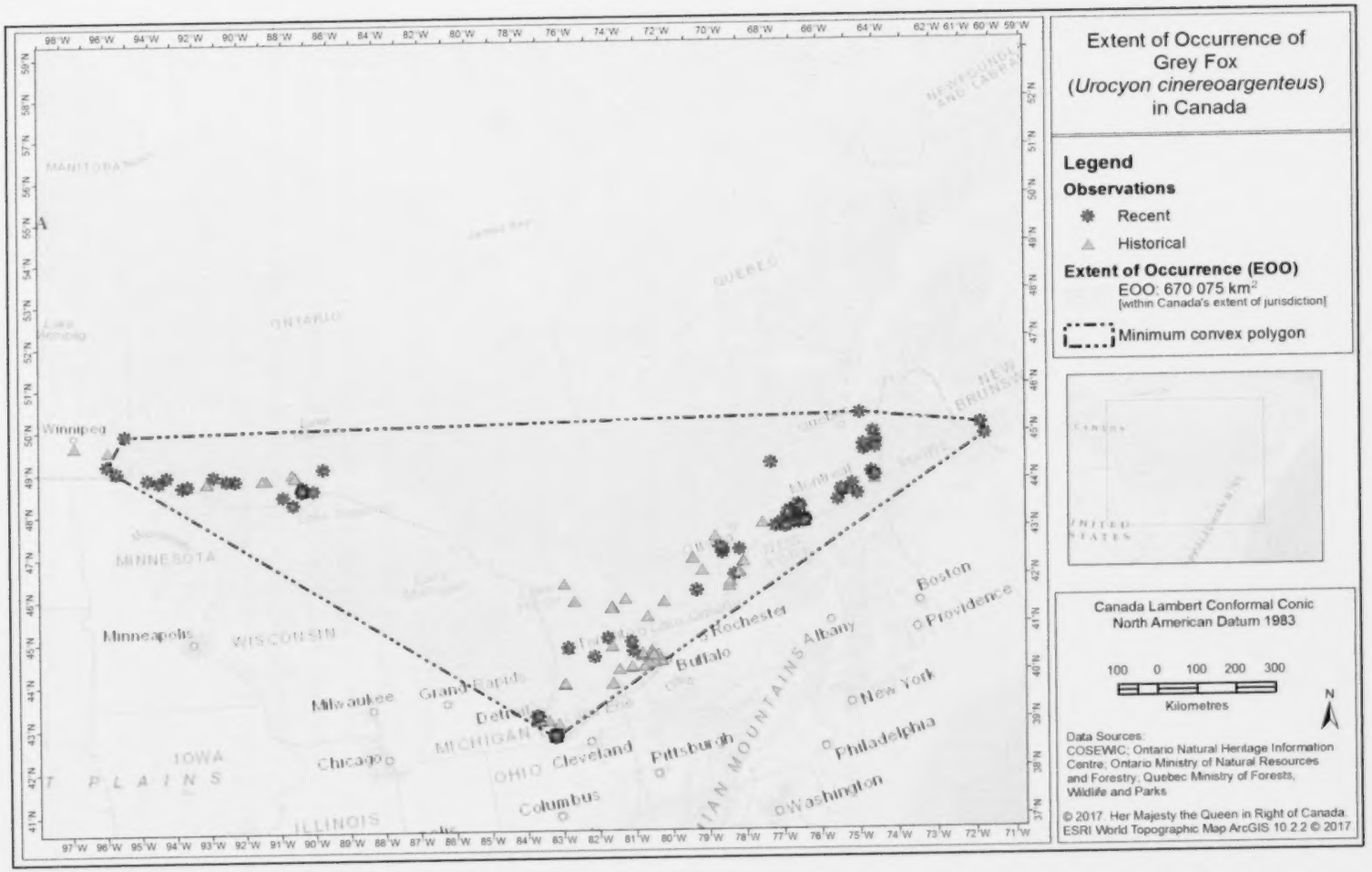

Figure 2. Extent of Occurrence (EOO) of the Grey Fox (*Urocyon cinereoargenteus*) in Canada, based on recent (*i.e.*, 1996 – early 2016) records (indicated by stars) of Grey Fox in Manitoba, Ontario, Quebec and New Brunswick. Historical records (< 1996) indicated by triangle. A single record from close to Lake Athabasca in Alberta, which is not considered to be representative of an established population of Grey Fox, is not shown (Updated from map in COSEWIC 2015b).

3.3 Needs of the Grey Fox

Despite its large range, relatively little research has been conducted on the Grey Fox, and basic ecological and demographic data are lacking in all major habitats (Cypher et al. 2008).

Grey Foxes are habitat generalists (Judge and Haviernick 2002; Riley 2006; Farías et al. 2012), and have been documented using a variety of habitat types including forests, brush, agricultural lands, marshes, urban areas and reclaimed surface mines (Chamberlain and Leopold 2000; Judge and Haviernick 2002; Cypher 2003; Aldridge 2008; Cooper et al. 2012; Erb et al. 2012; Farías et al. 2012; Kapfer and Kirk 2012; Nogeire et al. 2013). Nevertheless, Grey Foxes are thought to be most strongly associated with deciduous forest (Fritzell and Haroldson 1982; Cypher 2003; COSEWIC 2015b); indeed, Grey Foxes are thought to use a greater proportion of wooded habitat than other North American fox species (Cypher 2003). In eastern North America, Grey Foxes tend to prefer deciduous or southern pine forests interspersed with some old fields and scrubby woodlands, while in western North America they are commonly found in agricultural/woodland/chaparral[15]/riparian landscapes and shrub habitats (Cypher et al. 2008). In Canada, the only detailed information on habitat use comes from an adult Grey Fox that was radio-tracked from October 1980 to November 1981 in Lambton County, Ontario (Bachmann and Lintack 1982). This individual was associated most often with woodlot and woodlot edge, but also used fallow/idle fields and occasionally crossed roads. Bowman et al. (2013) monitored Grey Foxes with motion cameras on Pelee Island in 2012 and 2013. However, all cameras were placed in similar habitats, so this study provides little additional habitat use information.

Similar to their habitat use, the diet of Grey Foxes is thought to be variable and is dependent on both season and geography (Cypher 2003). They feed opportunistically depending on food availability, and are considered the most omnivorous[16] of all North American canids (COSEWIC 2015b). Vegetable matter, such as fruit, is important in the diet of Grey Foxes year-round, particularly in the fall (COSEWIC 2015b). In the winter, rabbits and other small mammals dominate the diet, whereas in the summer, insects (especially Orthoptera[17]) are most important (Fritzell and Haroldson 1982). Carrion and birds are also frequently consumed (Cypher 2003; McAlpine et al. 2008). In southern California, Larson et al. (2015) studied 58 scats from Grey Foxes and found that 88% of scats contained mammal remains, 43% contained fruit and seeds, 21 % contained invertebrates, 12 % contained birds and 12 % contained anthropogenic items.

[15] A type of stunted (scrub) woodland found in temperate regions with little summer rainfall. In North America, found primarily in California and northern portion of the Baja California Peninsula, Mexico.
[16] Feeding on food of both plant and animal origin.
[17] Insect order including grasshoppers and crickets.

Published estimates of home range size for Grey Foxes vary widely between <30 ha to over 1000 ha (Chamberlain and Leopold 2000; Judge and Haviernick 2002; Cypher 2003; Riley 2006; Temple et al. 2010; COSEWIC 2015b). Kelt and Van Vuren (2015) estimated a weighted average home range size of 274 ha based on published estimates. Home range sizes can vary with habitat quality, sex and season; typically, home ranges of males are larger than females, and home range sizes for both sexes increase in late fall and winter (Cypher 2003). The home range of an unmated male Grey Fox radio-tracked in Ontario varied from 210 ha in March-November to 1570 ha January-February (Bachmann and Lintack 1982). Caution is needed when interpreting data on home range sizes, as estimates tend to increase with the length of time the animal is monitored.

Grey Foxes disperse primarily in the fall (Lord 1961; Nicholson et al. 1985). Dispersal behaviour appears to vary widely between populations, but in general males tend to move further than females (COSEWIC 2015b). Dispersal distances in the range of 0-10s of kilometers (up to about 50 km) are commonly reported (reviewed by Cypher 2003; reviewed by COSEWIC 2015), and genetic analysis of Grey Foxes in Texas also suggests that movement on the order of tens of kilometers may be fairly common (DeYoung et al. 2010). However, there are at least two documented examples of individual Grey Foxes moving over 80 km (Sullivan 1956; Sheldon 1953).

The timing of the mating season for Grey Foxes in Canada has not been documented. However, Grey Foxes from the northern part of their range are known to mate later than Grey Foxes from the southern part of their range (Trapp and Hallberg 1975; Fritzell and Haroldson 1982; Fritzell 1987). Therefore, based on data from neighbouring populations in the U.S., it is assumed that mating season in Canada is between mid-February to mid-March or later (COSEWIC 2015b). Both males and females become sexually mature as early as 10 months (Follman 1978; Root 1981). The average litter size is 3.7 pups, and females produce one litter per year (Fritzell and Haroldson 1982). The gestation period[18] of Grey Foxes is thought to range between 53 and 63 days and young leave the den to forage with the mother at about 2.5-3 months of age (Fritzell and Haroldson 1982; Judge and Haviernick 2002; Cypher 2003).

Grey Foxes use dens for pup rearing and for resting (Aldridge 2008). A variety of features have been reported as being used as dens including: underground burrows dug by other animals, hollow trees, hollow logs, woodpiles, rocky outcrops, cavities under rocks, piles of brush, slab, wood or sawdust, and abandoned buildings (Judge and Haviernick 2002; Aldridge 2008). Dens tend to be located in areas with dense brush and within 400 m of a permanent source of water (Judge and Haviernick 2002; Aldridge 2008). In Ontario a total of five dens have been documented, three in brush piles (Bachmann and Lintack 1982), one under a shed, and one under armour stone at the base of a dock (McFarlane pers. comm. 2015).

[18] The time in which a fetus develops, beginning with fertilization and ending at birth.

4. Threats

4.1 Threat Assessment

The Grey Fox threat assessment is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system. Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational). Limiting factors are not considered during this assessment process. Historical threats, indirect or cumulative effects of the threats, or any other relevant information that would help understand the nature of the threats are presented in the Description of Threats section. The following threat assessment is closely based on the threat assessment carried out during the most recent COSEWIC assessment of Grey Fox (COSEWIC 2015b).

Table 1. Threat classification table for Grey Fox.

Threat #	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]	Detailed threats
4	Transportation & service corridors					
4.1	Roads & railroads	Unknown	Pervasive	Unknown	High	Road mortality
5	Biological resource use					
5.1	Hunting & collecting terrestrial animals	High	Pervasive - Large	Serious	High	Incidental trapping of Grey Fox in traps set for other species; assessed under third level threat category '5.1.2 Unintentional effects (species being assessed is not the target)'
8	Invasive & other problematic species & genes					
8.1	Invasive non-native/alien species	Unknown	Pervasive	Unknown	Moderate	Canine distemper
8.2	Problematic native species	Unknown	Large	Unknown	High	Rabies

[a] **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

[b] **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

[c] **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

[d] **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

4.2 Description of Threats

Each threat is described below in decreasing order of level of impact.

Threat 5.1: Hunting & collecting terrestrial animals – High Impact

In the majority of the Grey Foxes' range in Canada, targeted trapping of Grey Fox is not permitted; in Ontario there has been a zero quota set on trapping licenses for Grey Foxes since 2000 (MacDonald pers. comm. 2014), and in Quebec hunting and trapping regulations prohibit sport hunting and trapping of Grey Foxes (*Act respecting the conservation and development of wildlife*[19]). Nevertheless, Grey Foxes are captured and frequently killed in traps set for other animals (MacDonald pers. comm. 2014; Dalpé-Charron pers. comm 2016), referred to as incidental capture or by-catch. While there may have been limited hunting for Grey Foxes on Pelee Island in the past (see below), Grey Foxes are not known to be currently hunted anywhere in Canada. Therefore, this threat is assessed under the third level IUCN threat heading '5.1.2 Unintentional effects (species being assessed is not the target)'.

Judge and Haviernick (2002) reported that approximately six to seven Grey Foxes were harvested each year from the Whiteshell Provincial Park region in southeastern Manitoba. However, no pelts have been traded recently in Manitoba (COSEWIC 2015b).

Ontario trapping records indicate that between 1979 and 2014, an average of approximately seven Grey Foxes was trapped as by-catch per year[20] (MacDonald, pers. comm., 2014). The rate of by-catch has increased slightly over this time (average increase of 0.3 captures per year) (MacDonald pers. comm., 2014). There was a bounty on Grey Foxes on Pelee Island until the 1980s (Judge and Haviernick 2002). In the 1990s, hunters were estimated to have shot six to ten Grey Foxes on the island every winter, but there is no indication that this affected population size (Judge and Haviernick 2002). There is no recent information on whether hunting or incidental trapping of Grey Foxes is currently taking place on Pelee Island.

Quebec hunting and trapping regulations stipulate that sport hunting and trapping of Grey Foxes are prohibited in Quebec. Dead captured animals must be reported to a wildlife protection officer and are automatically confiscated (*Act respecting the conservation and development of wildlife*) (Ministère des Forêts, de la Faune et des Parcs 2014). Of the 37 Grey Foxes reported in Quebec between 1996 and early 2016, at least 29 were reported by trappers (COSEWIC 2015b; Dalpé-Charron pers. comm 2016). The high number of trapped Grey Foxes reported is due to the legal obligation to report these incidental captures to authorities.

[19] http://legisquebec.gouv.qc.ca/en/ShowDoc/cr/C-61.1,%20r.%204

[20] Records are maintained of Gray Fox trapped in Ontario, but specimens are not checked by experts, so some records may be incorrectly identified Red Fox (MacDonald, pers. comm., 2014).

One of the two records of Grey Foxes from New Brunswick was captured in a trap set for a beaver (McAlpine et al. 2008).

It is difficult to fully evaluate the impact of incidental trapping on Grey Fox populations in Canada, due to lack of good data on population sizes and trends. In addition, due to its secretive and nocturnal behaviour, Grey Foxes are not regularly encountered by the public, and so a large proportion of the records of Grey Foxes in Canada are from trappers. Information from the U.S., where trapping is legally permitted, provides some indication that Grey Foxes can sustain high trapping pressure. Hunting and trapping is the leading cause of human induced mortality in Grey Foxes in the U.S. (Cypher 2003; COSEWIC 2015b), and the number of Grey Foxes harvested has been very high in some regions. For example, almost half of the Grey Fox population was estimated to be harvested annually in Wisconsin in the mid-1970s (Judge and Haviernick 2002). However, numbers of Grey Foxes harvested have been maintained over time and over much of the U.S. range, suggesting that Grey Foxes can reproduce at rates high enough to sustain their population size under considerable harvest pressure (COSEWIC 2015b). The Canadian population is not directly comparable to the U.S. population however, as reproduction in Canada outside Pelee Island is either very rare or non-existent and population density in much of the Canadian range is low or very low. Therefore the incidental capture of Grey Foxes in traps set for other animals is considered likely to be limiting the establishment of Grey Fox breeding populations in parts of Canada (COSEWIC 2015b), and is therefore given a severity level of serious.

Both live traps and killing traps are used in Canada for trapping canids including Red Foxes (Fournier et al. 2014), and therefore could potentially capture Grey Foxes, even when they are not the target species. Best management practices for trapping are available, and traps are rated on selectivity (risk of injury for live traps; gear effectiveness, etc.) and humaneness (risk of injury for live traps, speed of death for killing traps) (Association of Fish and Wildlife Agencies 2006; Association of Fish and Wildlife Agencies 2014; Fournier et al. 2014; Ontario Ministry of Natural Resources and Forestry 2016). Use of selective traps may reduce by-catch of Grey Foxes, and the voluntary use of live traps certified compliant with international humane trapping standards and the development of best practice guides could potentially reduce incidental take from trapping.

Threat 4.1: Roads & railroads - Unknown Impact

Grey Foxes are predicted to have relatively high vulnerability to road mortality, compared to other mammals studied (Rytwinski and Fahrig 2011). Road mortality of Grey Foxes has been reported in both the U.S. (e.g. Temple et al. 2010) and in Ontario and Quebec (COSEWIC 2015b). There are less than ten records of road mortalities of Grey Foxes in Canada (representing approximately 7% of all records of Grey Foxes in Canada), but it is estimated that only about 25% of wildlife-vehicle mortalities are reported (Wildlife Collision Prevention Program 2016; D. Ghikas, pers. comm. 2016), so the actual number of road mortalities is likely to be much higher. In addition, people recovering or reporting road kill may not be able to identify Grey Foxes (as compared to

Red Foxes or foxes with hybrid coloured fur), further reducing the reported road mortality for Grey Foxes. The number of vehicle-wildlife mortalities reported in Ontario increased by about 50% between 1996 and 2001 (Elzohairy et al. 2004). While this increase is partly due to increased reporting rates, it nevertheless suggests that road mortality pressure is likely to be increasing. COSEWIC (2015b) rates the severity of this threat as 'neutral or potential benefit', but notes that road mortality actually 'degrades/reduces the affected occurrences', and notes that this threat 'likely limits expansion'. As little is known about the population-level impact of road mortality on Grey Foxes in Canada, the severity and therefore level of impact for this threat is ranked unknown.

Threat 8.1 : Invasive non-native/alien species and Threat 8.2: Problematic native species – Unknown Impact

While Grey Foxes face a range of disease and parasites (reviewed by Fritzell and Haroldson 1982), two in particular are known to have potential population-level effects in this species. Rabies and canine distemper are common and fatal viral diseases of Grey Foxes in the U.S. (Davidson et al. 1992; Steelman et al. 2000), and are potentially present in Canada. Two cases of Grey Foxes dying of rabies are known from Ontario, both from 1986, a peak year for rabies with the highest number of rabies cases of all species in Ontario to date (COSEWIC 2015b). Since 1970, six Grey Foxes have been trapped for rabies surveillance in Ontario (COSEWIC 2015). There is no record of a Grey Fox dying of canine distemper in Canada, but there is potential for Grey Foxes in Canada to be exposed to this disease (COSEWIC 2015b). Based on a study of 157 Grey Fox submitted to the Southeastern Cooperative Wildlife Disease Study, Davidson et al. (1992) suggest that canine distemper was the major disease affecting Grey Fox in that region in the 1970s and 1980s. In a study of 26 Grey Foxes in Alabama in 1878-1980, the mortality from canine distemper (36%) was greater than the mortality from trapping (29%), and affected primarily adults, whereas trapping affected young animals (Nicholson and Hill 1984). Outbreaks of canine distemper can produce population reductions in Grey Foxes, and populations may take several years to recover (Nicholson and Hill 1984; Chamberlain and Lepold 2000). Given that both canine distemper and rabies are fatal to Grey Foxes, and spread easily in wild populations, either disease has the potential to be a limiting factor to Grey Fox in an outbreak situation (COSEWIC 2015b). However, the prevalence of any disease in Canadian Grey Foxes is unknown, because few animals have been assessed (COSEWIC 2015b). Unlike many wild canids, Grey Foxes are resistant to sarcoptic mange mites and heartworm (COSEWIC 2015b).

4.3 Limiting factors

Due to the small population size of Grey Foxes in Canada, any factor that leads to elevated levels of mortality could become a significant limiting factor (COSEWIC 2015b). For example, range expansion and therefore establishment of new sub-populations in Canada may be limited by high Coyote densities. Coyotes can kill Grey Foxes (Wooding 1984; Fedriani et al. 2000; Farías et al. 2005), and there is

evidence that Grey Foxes avoid Coyotes (Crooks and Soulé 1999). In California, Coyote and Grey Fox abundance were found to be inversely related (i.e. Grey Foxes were more abundant in areas of low Coyote density, Crooks and Soulé 1999; Fedriani et al. 2000), and Grey Fox numbers increased after Coyote removal in Texas (Henke and Bryant 1999). However, no information is available on how Coyote predation impacts Grey Foxes at a population level.

The small size and relative isolation of the Pelee Island population makes it particularly vulnerable to unpredictable events such as demographic stochasticity, extreme weather events and disease as well as to inbreeding due to lack of genetic diversity. Population declines in adjacent populations in Ohio (OHDNR 2014) may reduce the probability of a rescue effect for this population (COSEWIC 2015b).

It has been suggested that climate may limit the northern range limit of Grey Foxes, due to energy costs of movement in deep snow (Judge and Haviernick 2002). In addition, Root and Payne (1985) suggested that sensitivity of colder environments might partially explain the relatively small average litter size they found in northern Wisconsin.

5. Population and Distribution Objectives

Since at least the 1940s, the abundance of Grey Foxes in Canada has been slowly increasing, after an extirpation that lasted at least two centuries. The prospects for a continued natural recovery are considered good, given the recent evidence of a new sub-population in northwestern Ontario, increasing records and weak evidence of breeding in southern Quebec and range expansion and population increases in adjacent populations in the northeastern U.S. (COSEWIC 2015b). The population and distribution objectives for the Grey Fox in Canada are:

1) Maintain the sub-population on Pelee Island;
2) Maintain the northwestern Ontario sub-population and support natural increase of abundance and distribution in this region;
3) Maintain the current distribution of the Grey Fox in Canada, and support natural establishment and expansion of any newly identified or newly established sub-populations of the Grey Fox in Canada.

Given the lack of accurate information on population size, the population and distribution objectives do not set quantitative goals. However, maintenance of established sub-populations will help ensure the persistence of the species in Canada. The uncertainties around Grey Fox abundance, distribution, and the possible existence of cross-border populations mean that there are a range of potential objectives that could be selected. Therefore, requirements for research to establish baseline population abundance, distribution and importance of cross-border links are outlined in the Recovery Planning Table (Table 2), and this information can be used to update objectives in the future.

Maintaining the Pelee Island sub-population is key to the survival of Grey Foxes in Canada, as it is the only sub-population with documented breeding, and is thought to contain a large proportion of the mature animals in the Canadian population (estimated as less than 60 mature individuals, COSEWIC 2015b). However, growth of the sub-population on Pelee Island is limited by total area of the island so the goal for this sub-population is to maintain the population size at approximately 60 mature individuals. This represents an average density of approximately 1.4 individuals/km^2 (measured over the whole island, COSEWIC 2015b). It is unclear at present if this population receives dispersing individuals from adjacent U.S. populations (COSEWIC 2015b). Grey Fox populations in Ohio, the closest state to Pelee Island, have been declining (OHDNR 2014), so even if immigration does occur, it may be more limited than in the past. Therefore, the genetic viability of the Pelee Island sub-population may become problematic in the future due to the small population size and limited immigration.

In contrast to the Pelee Island sub-population, the extensive area of forest in northwestern Ontario (Ontario Partners in Flight 2008) provides a large amount of potential habitat for Grey Foxes. This should allow for a natural increase in abundance and distribution of this sub-population, which is currently estimated at less than 50 mature individuals (COSEWIC 2015b). Maintaining and supporting the continuing natural increase of the sub-population in this region supports both survival and recovery of Grey Foxes in Canada. However, it is unclear at present how reliant this population is on dispersing individuals from the U.S. (Van den Broeck 2014a). Maintaining connectivity with adjacent populations in the U.S. may be important for the future viability of this population.

Given that the Grey Fox has naturally recolonized Canada from adjacent populations in the U.S., and that most of these U.S. populations appear to be stable or increasing at this time (COSEWIC 2015b), the objectives support maintenance of the current distribution as well as continued natural expansion of both the population size and distribution of the Canadian population, by supporting newly identified or newly established sub-populations[21]. This strategy will rely on the continued ability of Grey Foxes to disperse into Canada and does not promote active re-introduction. Supporting natural establishment and expansion of any new sub-populations supports the recovery of the Grey Fox in Canada. If new sub-populations are identified or established, population and distribution objectives for these new sub-populations can be developed in future action plans or an amended Recovery Strategy as necessary.

[21] New sub-populations comprise geographically or otherwise distinct groups in the population between which there is little demographic or genetic exchange (COSEWIC 2015a) with direct breeding evidence (e.g. record of kits or lactating female, COSEWIC 2015).

6. Broad Strategies and General Approaches to Meet Objectives

6.1 Actions Already Completed or Currently Underway

There has been only one study conducted on Grey Foxes in Ontario in the last twenty years. The objective of the study was to create a spatial occupancy model for Grey Foxes on Pelee Island (Bowman et al. 2013). Camera traps were set in 30 grid cells, each 30 ha in size, located on conservation lands on the island. Cameras were in place between 31 May 2012 and 13 May 2013, for approximately one month in each of the 30 grid cells. Grey Foxes were captured on camera 16 times in eight different grids. Next steps for the project will involve estimating detectability and occurrence of Grey Foxes and developing a predictive model of Grey Fox occurrence on the island.

Pelee Island has received particular conservation attention for both habitat protection and restoration. Protection and maintenance of existing forest habitat has been undertaken by Ontario Nature (formerly the Federation of Ontario Naturalists), and the Essex Region Conservation Authority and the Nature Conservancy of Canada. Habitat restoration has occurred on Pelee Island, particularly through the Nature Conservation of Canada. Efforts include restoring agricultural and aggregate lands to forest and prairie areas and removal of invasive species.

In Quebec, outreach efforts have begun with trappers to promote voluntary reporting of sightings or incidental capture of Grey Foxes.

6.2 Strategic Direction for Recovery

To work towards achieving the population and distribution objectives, six broad strategies for recovery have been established, and are outlined in Table 2. The broad strategies are:

- Communication and outreach;
- Surveys and monitoring;
- Habitat stewardship and conservation;
- Research;
- Protection and management;
- Law and Policy.

Table 2. Recovery Planning Table

Threat or Limitation	Priority[a]	Broad Strategy to Recovery	General Description of Research and Management Approaches
Knowledge gap: species distribution; Habitat connectivity and availability.	High Medium	Communication and outreach	• Develop and implement a communications strategy aimed at eliciting observations in areas of historic and recent Grey Fox records. Resulting observations should be submitted to provincial Conservation Data Centres. The communications strategy should include materials outlining key identification characteristics for the Grey Fox, and comparison with similar species. Target groups for the strategy include those likely to observe or encounter Grey Foxes (e.g., trappers, hunters, First Nations, logging personnel (including truck drivers), road crews) • Establish relationships with partners in the U.S. with the goal of maintaining cross-border habitat connectivity and cross-border movement of Grey Foxes where possible
Knowledge gap: population size and demography; species distribution	High Medium	Surveys and monitoring	• Conduct basic population size, habitat use and demographic studies on Pelee Island to determine baseline population size, demographics and habitat use. • Conduct basic population size, habitat use and (where possible) demographic studies in northwestern Ontario to confirm evidence of breeding, baseline population size, demographics and habitat use. • Develop and use a standardized population monitoring method in all sub-populations to establish population trends. • Conduct studies in southern Quebec to assess whether mature and reproductive Grey Foxes are resident and/or breeding. • Monitor reported records (generated by communication and outreach strategy or other reports) for evidence of new sub-populations. Determine breeding status of any newly discovered or newly established sub-populations. • Establish and monitor the importance of cross-border linkages with U.S. population to the size and persistence of the Canadian population. • Improve reporting of road mortality incidents involving Grey Foxes.
Habitat connectivity and availability	Medium	Habitat stewardship and conservation	• Collaborate with agencies holding conservation land on Pelee Island to maintain or increase forested habitat and areas with a matrix of forest and open/semi-open habitats through conservation, stewardship and, where feasible, restoration. • Develop and/or contribute to stewardship information for private landowners on Pelee Island to encourage maintenance/restoration of forested habitat. • Promote a landscape level planning approach to maintain forest area and connectivity in regions where Grey Fox are thought to disperse into Canada (e.g. northwestern Ontario, southern Quebec).

Threat or Limitation	Priority[a]	Broad Strategy to Recovery	General Description of Research and Management Approaches
			• Encourage conservation and stewardship of forests on private lands to help maintain forest habitat and healthy forest ecosystems in these same areas.
Trapping; Disease; road mortality; knowledge gap: Pelee Island population viability	High Medium	Research	• Clarify the impact of incidental trapping on the Grey Fox population in Canada. Investigate methods of reducing by-catch of Grey Foxes in traps set for other animals. • Study genetic variability of Pelee Island sub-population to establish whether genetic isolation is a potential threat to population viability. • Determine the severity of road mortality on the Grey Fox population in Canada. • Clarify the potential impact of diseases on Grey Fox population in Canada. • Conduct disease surveillance in Grey Foxes by performing necropsies on reported carcasses to look for potential pathologies and parasites.
Trapping	High	Protection and management	• Support development and promotion of best management practices (BMPs) to reduce by-catch of Grey Foxes in traps set for other animals, based on research activity above.
All threats	High	Law and Policy	• Promote compliance with existing laws, regulations and policies to prevent breaches and offenses detrimental to Grey Foxes, for all types of activities on all types of land tenures

[a] "Priority" reflects the degree to which the broad strategy contributes directly to the recovery of the species or is an essential precursor to an approach that contributes to the recovery of the species.

7. Critical Habitat

7.1 Identification of the Species' Critical Habitat

Section 41 (1)(c) of SARA requires that recovery strategies include an identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction. Under section 2(1) of SARA, critical habitat is "the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species".

This federal recovery strategy identifies critical habitat for the Grey Fox in Canada, to the extent possible, based on the best available information as of February 2016. Critical habitat is identified for the Pelee Island sub-population in Ontario (see Figure 3 and Table 4). It is recognized that the critical habitat identified below is insufficient to achieve the population and distribution objectives for this species. A Schedule of Studies (Section 7.2; Table 5) has been developed and outlines the activities required to complete the identification of critical habitat in support of the population and distribution objectives.

The identification of critical habitat for the Grey Fox in Canada is based on two criteria: habitat occupancy and habitat suitability.

7.1.1 Habitat Occupancy

The habitat occupancy criterion refers to areas that have been documented as being used for breeding purposes and where there is a reasonable degree of certainty of current use by the species. Due to the secretive nature of the species, confirming habitat use for breeding is difficult. A multiple occupancy criteria will be used to indicate areas where breeding has likely occurred and where there is long-term habitat use.

Habitat is considered occupied when:

- A record from the breeding season (February 15-August 31) is in close proximity to at least one other record of a Grey Fox (from any time of year) AND
- the breeding season record and at least one other record in close proximity occur at least one year apart.

Following NatureServe (2009) guidelines for Grey Fox element occurrence[22] separation distances, records are considered in close proximity when:

- They occur within 5 km of one another; OR

[22] Basic unit of record for documenting and delimiting the presence and extent of a species on the landscape

- They occur within 15 km of one another, but are linked by continuous suitable habitat.

Judge and Haviernick (2002) estimated the Canadian mating season to be from mid-February to mid-March or later, based on extrapolation from neighbouring populations in the U.S. The gestation period is estimated at 53-63 days, and pups are dependent on the mother for 2.5-3 months (Fritzell and Haroldson 1982; Judge and Haviernick 2002; Cypher 2003). Therefore, records from February 15 to August 31 are included as breeding season records, to cover the period when Grey Foxes are engaged in mating and breeding activities. To avoid including historical records, only records within a ten year period (2006-2015) are considered. The ten-year time frame is used to approximate twice the average life-expectancy of Grey Foxes in the wild (COSEWIC 2015b), and to account for the cryptic nature of the species and absence of systematic surveys. Records must be at least one year apart to demonstrate that individuals are using the habitat over multiple years. Habitat occupancy is based on observations of Grey Foxes (live or dead) including documented denning locations, camera trap survey data, trapping records, published reports and incidental observations accepted by the regional Conservation Data Center or similar organization or species expert. Records must have a spatial accuracy of 1 km or better to be considered for the occupancy criteria.

7.1.2 Habitat Suitability

Habitat suitability refers to areas possessing a specific set of biophysical attributes that support individuals of the species in carrying out essential life cycle activities (e.g., breeding, denning, foraging, and resting) as well as their movements. Generally, suitable habitat for the Grey Fox is a mosaic of wooded areas and open and semi-open habitats, in which specific biophysical attributes can be associated with essential life cycle activities. The biophysical attributes of suitable habitat are detailed in Table 3.

Suitable habitat is only described for Grey Foxes on Pelee Island at this time, as there is not enough information on how Grey Foxes are using habitat in other parts of Canada, including northwestern Ontario, to identify the appropriate biophysical attributes required by the species or their configuration at an appropriate scale. In parts of northwestern Ontario and elsewhere where Grey Foxes are recorded, there are extensive tracts of continuous or nearly continuous forest and it is not clear how Grey Fox use this type of habitat, or whether breeding habitat is limited in these regions. In contrast, habitat use on Pelee Island is constricted by the size of the island itself and the limited amount of forest available, so critical habitat is identified at an area scale[23]. However, the wide

[23] Environment and Climate Change Canada recognizes three broad approaches in identifying critical habitat: site-level (small/localized geographic range, narrow habitat specificity), area-level (intermediate geographic range, wide or narrow habitat specificity), and landscape-level (large geographic range, wide habitat specificity) (Environment Canada 2013). These three conceptual scales are used to help provide context for the critical habitat identification, its presentation, and description of activities likely to destroy critical habitat.

habitat specificity of the Grey Fox, together with the more extensive habitat availability in other regions, and large home-range size of this species, suggest that suitable habitat for Grey Foxes outside Pelee Island could be more appropriately described at a landscape scale[23]. As such, the Schedule of Studies (section 7.2) develops activities to gather the information necessary to confirm and identify biophysical attributes at the optimal scale in the future.

Suitable habitat for Grey Foxes on Pelee Island can be described using the Ecological Land Classification (ELC) framework for Ontario (from Lee et al. 1998), which provides a standardized approach to the interpretation and delineation of dynamic ecosystem boundaries. The ELC approach classifies habitats not only by vegetation community but also considers hydrology[24] and topography[25], and as such encompasses the biophysical attributes of the habitat for Grey Foxes. In addition, ELC terminology and methods are familiar to many land managers and conservation practitioners who have adopted this tool as the standard approach for habitat classification in Ontario, including on Pelee Island.

For additional clarity, and based on best available information, the biophysical attributes describing Grey Fox suitable habitat can be defined within the following ELC Community Series designations: Deciduous Forest (FOD); Coniferous Forest (FOC); Mixed Forest (FOM); Plantation (CUP); Tallgrass Savanna (TPS); Tallgrass Woodland (TPW); Cultural Meadow (CUM); Cultural Thicket (CUT); Cultural Savanna (CUS); and Cultural Woodland (CUW).

Within areas of suitable habitat, the biophysical attributes required by the Grey Fox will vary over space and time with the dynamic nature of ecosystems. Biophysical attributes do not need to be immediately adjacent to each other, as long as they remain connected so that individuals can easily move between them to meet all their biological needs and respond to or avoid disturbances or threats as required. The distance determining the extent of suitable habitat is specific to the Grey Fox and is based on the species' biological and behavioural requirements. In addition, particular biophysical attributes will be of greater importance to individuals at different points in time (e.g., during different life processes, seasons or at various times of the year).

- The extent of suitable habitat is defined as the entire ELC community series polygon(s) (listed above), located within a radial distance of 934 m of a known record of a Grey Fox. If the habitat patch extends beyond the radial distance it is included in suitable habitat.

Grey Foxes use home ranges to allow them to access enough habitat to complete their essential life cycle activities, including finding enough food. This home range may be particularly important where suitable habitat is fragmented such as on Pelee Island. The distance used to set the suitable habitat boundary (934 m) is based on the average

[24] The movement, distribution, and quality of water.
[25] The arrangement of the natural and artificial physical features of an area.

home range of the species, estimated at 274 ha[26] (Kelt and Van Vuren 2015). Since the estimated home range size for this species varies widely (see Section 3.3), and information on home range size of the Grey Fox in Canada is very limited, this value is based on an average of published estimates in several habitats in the U.S.. A study has been added to the Schedule of Studies (section 7.2) to address the need for a better understanding of home range size in Canada.

The suitable habitat described above will include the majority of potential denning habitats, which is important considering few precise denning locations are known. In addition, known denning sites wherever they occur are also identified separately from the more general habitat because of their close relationship with survival and recruitment of individuals. Dens are one of the most important habitat features for the Grey Fox as they are critical for parturition[27] and pup rearing, and to avoid predators. Therefore, suitable habitat for the Grey Fox also includes:

- The area within a 100 m radial distance from a Grey Fox den.

Confirmed den features and the area within a 100 m radial distance around a denning feature may include any habitat type, and are identified as critical habitat wherever they are located (they do not need to occur in ELC polygons of suitable habitat). The purpose of this area is to maintain the physical and biological composition, structure and function of the surrounding environment, and to protect the area in the vicinity of the den.

Non-naturally occurring features (e.g., space underneath buildings: see Table 3) have been included in the identification of critical habitat for the Grey Fox. Suitable habitat for this species on Pelee Island is extremely limited, and individuals are known to utilize non-natural features for denning. Although it is not understood why Grey Foxes use these non-natural features instead of natural features which may occur nearby, the importance of dens to the successful reproduction of this species make them critical for the species' survival. Without this non-natural habitat individuals may not be able to successfully carry out their life functions, including parturition and pup rearing. If dens are not in use, and they need to be moved or disturbed, it may be possible to replace the function served by non-natural structures or features. However, this determination will need to be made on a case-by-case basis taking into consideration a number of factors including species' biology, potential risk to the species, the availability of natural and non-natural features in the surrounding area, and options for mitigation or replacement.

Active agricultural fields in row crops or in crop rotation (including vineyards), are not identified as critical habitat as they do not provide optimal habitat, due to lack of cover and relatively low food availability for Grey Foxes. Roads pose a mortality threat to Grey Foxes, and while they may be crossed, they do not possess the biophysical

[26] When converted to a linear distance, this equates to a radial extent of 934 m.
[27] The act or process of giving birth.

attributes of suitable habitat or assist in the maintenance of natural processes, and therefore are also not identified as critical habitat.

Table 3. Detailed Biophysical Attributes of Suitable Habitat for Grey Fox.

Life Cycle Activities	Biophysical Attributes	References
All life processes (Breeding, Denning, Foraging, Resting, Movement)	• Landscapes that provide a mosaic of wooded areas and open and semi-open areas. • Habitat types may include, but are not limited to: - Forests, Woodland, Thickets, Brush, or Hedgerows; AND, - Adjacent open and semi-open habitat types such as meadows, savannas, and old fields.	• Bachmann and Lintack 1982 • McAlpine 2008 • Cypher et al. 2008 • Judge and Haviernick 2002
• Denning (dens may be used during birthing and pup rearing, or to avoid predators)	• Den features are typically located in brushy or wooded areas close to a water source, and may include, but are not limited to: - Dug or modified burrows of other species; - Wood piles; - Brush piles; - Rock crevices; - Hollow logs and trees; - Hollows under shrubs; or, - Space underneath buildings.	• Bachmann and Lintack 1982 • Judge and Haviernick 2002

7.1.3 Application of the Grey Fox Critical Habitat Criteria

Critical habitat for the Grey Fox is identified as the extent of suitable habitat (section 7.1.2) where the habitat occupancy criteria is met (section 7.1.1).

Application of the critical habitat criteria to the best available information identifies critical habitat for the Grey Fox on Pelee Island in Canada (see Figure 3), totaling up to 320 ha[28]. Despite breeding season observations from other regions of Canada, including northwestern Ontario and southern Quebec, there are no records that meet the occupancy criteria outside of Pelee Island at this time. A schedule of studies has been developed to confirm habitat occupancy in the southern portion of Pelee Island where Grey Foxes have been infrequently observed in the last ten years and occupancy

[28] This area was identified using air photos; field verification may lead to some modifications in area and extent. Actual critical habitat occurs only in those areas that contain the biophysical attributes described in section 7.1 and in the areas within 100 m radial distance around known denning sites; therefore, the actual area could be less than reported and would require field verification to determine the precise amount.

criteria are not currently met and to gather information needed to identify critical habitat in other regions

The critical habitat identified is considered a partial identification of critical habitat because it is insufficient to meet the population and distribution objectives. A Schedule of Studies (section 7.2) has been developed to provide the information necessary to complete the identification of critical habitat that will be required to meet the population and distribution objectives. Additional critical habitat may be added in the future if new or additional information supports the inclusion of areas beyond those currently identified.

Critical habitat for the Grey Fox in Canada is presented using 1 x 1 km Standardized Universal Transverse Mercator (UTM) grid squares (Figure 3, see also Table 4). The UTM grid squares presented in Figure 3 are part of a standardized grid system that indicates the general geographic areas containing critical habitat, which can be used for land use planning and/or environmental assessment purposes. The areas of critical habitat within each grid square are defined by the criteria described in section 7.1.1 and 7.1.2. More detailed information on the location of critical habitat, to support the protection of the species and its habitat may be requested on a need-to-know basis by contacting Environment and Climate Change Canada – Canadian Wildlife Service at ec.planificationduretablissement-recoveryplanning.ec@canada.ca.

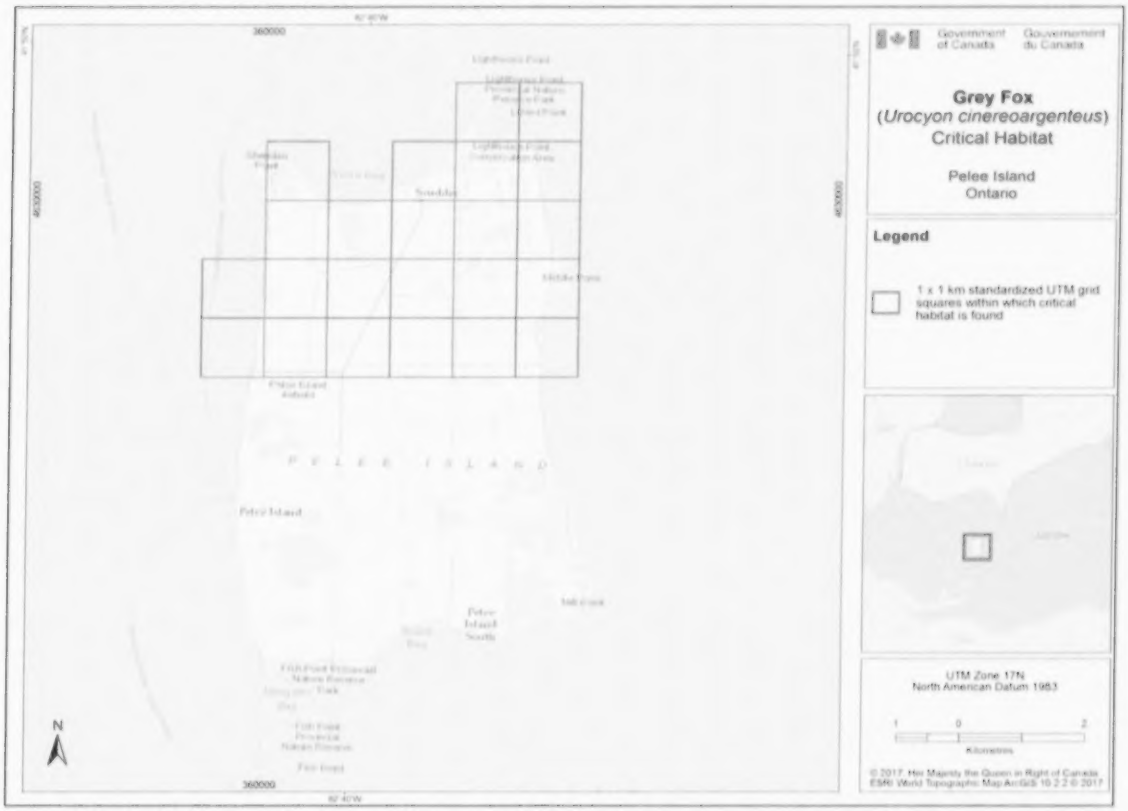

Figure 3: Grid squares that contain critical habitat for the Grey Fox in Canada. Critical habitat for Grey Fox occurs within these 1 x 1 km UTM grid squares (red squares), where the criteria described in section 7.1 are met.

Table 4: Grid squares that contain critical habitat for the Grey Fox in Canada. Critical habitat for the Grey Fox occurs within these 1 x 1 km UTM grid squares where the criteria described in section 7.1 are met.

Population	1 x 1 km Standardized UTM grid square ID[a]	Province	UTM Grid Square Coordinates[b]		Land Tenure[c]
			Easting	Northing	
Pelee Island	17TLG5297	Ontario	359000	4627000	Non-federal Land
	17TLG5298		359000	4628000	
	17TLG6207		360000	4627000	
	17TLG6208		360000	4628000	
	17TLG6209		360000	4629000	
	17TLG6217		361000	4627000	
	17TLG6218		361000	4628000	
	17TLG6219		361000	4629000	
	17TLG6227		362000	4627000	
	17TLG6228		362000	4628000	
	17TLG6229		362000	4629000	
	17TLG6237		363000	4627000	
	17TLG6238		363000	4628000	
	17TLG6239		363000	4629000	
	17TLG6247		364000	4627000	
	17TLG6248		364000	4628000	
	17TLG6249		364000	4629000	
	17TLG6300		360000	4630000	
	17TLG6320		362000	4630000	
	17TLG6330		363000	4630000	
	17TLG6331		363000	4631000	
	17TLG6340		364000	4630000	
	17TLG6341		364000	4631000	
					Total = 23 grid squares

[a] Based on the standard UTM Military Grid Reference System (see http://www.nrcan.gc.ca/earth-sciences/geography/topographic-information/maps/9789), where the first 2 digits and letter represent the UTM Zone, the following 2 letters indicate the 100 x 100 km Standardized UTM grid followed by 2 digits to represent the 10 x 10 km Standardized UTM grid. The last 2 digits represent the 1 x 1 km standardized UTM grid containing all or a portion of the critical habitat unit. This unique alphanumeric code is based on the methodology produced from the Breeding Bird Atlases of Canada (See http://www.bsc-eoc.org/ for more information on breeding bird atlases).

[b] The listed coordinates are a cartographic representation of where critical habitat can be found, presented as the southwest corner of the 1 x 1 km Standardized UTM grid square containing all or a portion of the critical habitat. The coordinates are provided as a general location only.

[c] Land tenure is provided as an approximation of the types of land ownership that exist at the critical habitat units and should be used for guidance purposes only. Accurate land tenure will require cross referencing critical habitat boundaries with surveyed land parcel information.

7.2 Schedule of Studies to Identify Critical Habitat

Critical habitat is partially identified in this recovery strategy and is considered insufficient to meet the population and distribution objectives (Section 5) for the Grey Fox. Critical habitat for the Grey Fox is not identified outside Pelee Island at this time, because there are currently no records outside Pelee Island that meet the occupancy criteria. Due to its wide habitat specificity, together with its relatively large home-range size (measured at over 1000 ha in some cases, Section 3.3), future identification of critical habitat outside Pelee Island, and especially in northwestern Ontario where there are large areas of continuous forest, should consider the possibility of identifying critical habitat at a landscape scale[29]. The following schedule of studies is designed to gather the information required to confirm the scale at which critical habitat should be identified for the northwestern Ontario sub-population, to meet the population and distribution objectives. The same information can be used to inform critical habitat identification for any newly discovered or newly established Grey Fox sub-populations in the future. In addition, many of the records from the northwestern Ontario sub-population and from southern Quebec are associated with the road network and it is not clear how these records relate to habitat use, so a study is included to investigate how Grey Foxes use roads and adjacent habitat. Finally, a study is included to determine the breeding status of Grey Foxes in the southern part of Pelee Island. Although there appears to be suitable habitat in this area, and Grey Foxes were recorded several times up to the late 1990s, there has only been one recent confirmed record in 2012, so the habitat occupancy criterion is not currently met.

[29] Environment and Climate Change Canada recognizes three broad approaches in identifying critical habitat: site-level (small/localized geographic range, narrow habitat specificity), area-level (intermediate geographic range, wide or narrow habitat specificity), and landscape-level (large geographic range, wide habitat specificity) (Environment Canada 2013). These three conceptual scales are used to help provide context for the critical habitat identification, its presentation, and description of activities likely to destroy critical habitat.

Table 5. Schedule of Studies to Identify Critical Habitat

Description of Activity	Rationale	Timeline
Improve understanding of Grey Fox distribution and habitat use in northwestern Ontario.	The majority of records in northwestern Ontario are either within 4km of the highway between Fort Frances and Thunder Bay, or associated with other major roads or built up areas. It is unclear whether this distribution reflects habitat use by Grey Foxes in this region, or the concentration of human observers in these areas. A better understanding of the distribution and habitat use of Grey Foxes in this region is needed in order to determine biophysical attributes required for recovery and survival.	2018-2023
Investigate how Grey Foxes use habitat adjacent to roads.	Grey Foxes are known to use habitat adjacent to roads in northwestern Ontario and southern Quebec. However, it is necessary to understand whether suitable habitat adjacent to roads provides habitat necessary for survival, and should therefore be identified as critical habitat, or whether the risk of road mortality makes these habitats sub-optimal and therefore unsuitable for critical habitat identification.	2018-2023
Determine breeding status of Grey Fox in the southern part of Pelee Island.	Necessary to determine whether Grey Foxes are still breeding in the southern part of Pelee Island, so that critical habitat can be identified if appropriate.	2018-2023
Investigate home range size of Grey Fox.	Home range size varies widely for this species, and the current estimate of home range size is based on studies from the U.S. in habitats that don't necessarily reflect the Canadian distribution. Studies of home range size in Canada are needed to define the scale at which Grey Foxes use habitat and other resources, so that critical habitat can be identified appropriately.	2018-2023
Monitor regions where Grey Fox populations are likely to be expanding (such as southern Quebec), and determine breeding status of Grey Fox populations in regions where breeding is suspected. Where breeding is confirmed investigate suitable habitat use.	Necessary to determine whether Grey Foxes are establishing breeding populations, so that critical habitat can be identified as appropriate.	2018 onwards

Determine how much habitat is required to meet population and distribution objectives in northwestern Ontario.	It is uncertain whether or not habitat is limiting for Grey Foxes in northwestern Ontario, or whether population is limited by some other factor (e.g. climate). If habitat is limiting, need to determine how much habitat is needed to achieve population and distribution objectives.	2024-2029
Determine appropriate configuration of biophysical attributes.	Necessary to understand what biophysical attributes are required as well as optimal configuration, once appropriate scale (e.g. landscape) is confirmed through studies outlined above.	2024-2029

7.3 Activities Likely to Result in the Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat was degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single activity or multiple activities at one point in time or from the cumulative effects of one or more activities over time. It should be noted that not all activities that occur in or near critical habitat are likely to cause its destruction. Activities described in Table 6 are examples of those likely to cause destruction of critical habitat for the species; however, destructive activities are not necessarily limited to those listed. For some activities, the identification of thresholds may lead to a refinement or more precise description of the aspects of a given activity that are likely to destroy critical habitat.

Table 6. Activities Likely to Result in the Destruction of Critical Habitat

Description of Activity	Description of Effect in Relation to Function Loss	Details of Effect
Activities resulting in destruction or alteration of natural or human-made structures providing den sites, and adjacent habitat (e.g. logging, land clearing, removal of abandoned buildings, etc.)	Includes the destruction or alteration of habitats which constitute a den and the 100m area surrounding it, as described in suitable habitat. Destruction or alteration of natural and/or human-made structures that provide denning sites and/or the adjacent habitat may cause temporary or permanent loss of birthing and adjacent cover habitat.	A single event, occurring at any time of year, is sufficient to destroy or alter denning habitat such that it is no longer suitable and if it occurs during the breeding season, has the potential to impact population recruitment. If human-influenced structures or features are used as den sites, it may be possible to replace the function served by these features should they need to be removed or disturbed. This determination will need to be done on a case-by-case basis taking into

		consideration a number of factors including the species' biology, potential risk to the species, the availability of natural and anthropogenic habitat features in the surrounding area, and options for mitigation or replacement.
Deforestation and forest alteration for any purpose; removing vegetation including trees from hedgerows for any purpose; removing trees from savanna for any purpose.	Activities leading to deforestation or forest alteration (i.e. permanent or temporary removal of tree or shrub cover) or other clearing or removal of trees, or other vegetation in the case of hedgerows, may result in direct permanent or temporary destruction of habitat used by Grey Fox for breeding, denning, foraging, resting and/or movement. Clearing or removal of trees or shrubs may also fragment or isolate suitable habitat, precluding access to resource areas.	While removal of a limited number of trees or shrubs may not be detrimental, clearing of most or all trees or shrubs will destroy critical habitat either permanently or temporarily (if trees are allowed to regrow). If this activity were to occur within the boundaries of critical habitat at any time of year, it is likely that the effects on critical habitat would be direct and cumulative.
Conversion of open or semi-open habitats, such as meadow or old field, to alternate land uses.	Conversion of these habitats to other land uses (for example by planting row-crops or for urban or infrastructure development) will result in direct and permanent loss of habitat that Grey Fox uses for breeding, denning, foraging, resting, movement. Natural succession of these habitats is unlikely to be detrimental to Grey Fox. Conversion of these habitats may also fragment or isolate suitable habitat, precluding access to resource areas.	If this activity were to occur within the boundaries of critical habitat at any time of year, it is likely that the effects on critical habitat would be direct and cumulative

8. Measuring Progress

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives.

1. The sub-population on Pelee Island has been maintained.
2. The sub-population in northwestern Ontario has been maintained. Strategies have been developed and are in place to support the natural increase of abundance and distribution in this area.
3. The Canadian distribution has been maintained. Strategies have been developed and are in place to support the natural establishment and expansion of any newly-identified or newly established sub-populations.

9. Statement on Action Plans

One or more action plans will be completed for the Grey Fox by December 31, 2025.

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Appendix A: Subnational Conservation Ranks of the Grey Fox (*Urocyon cinereoargenteus)* in Canada and the United States

Table A-1 – Conservation ranks of the Grey Fox in Canada and the United States (NatureServe 2015).

Grey Fox (*Urocyon cinereoargenteus*)				
Global (G) Rank	**National (N) Rank (Canada)**	**Sub-national (S) Rank (Canada)**	**National (N) Rank (United States)**	**Sub-national (S) Rank (United States)**
G5 (Secure)	N1	S1 (Ontario)	N5	Alabama (S5), Arizona (S5), Arkansas (S5), California (SNR), Colorado (S4), Connecticut (S5), Delaware (S5), District of Columbia (S3), Florida (SNR), Georgia (S5), Illinois (S5), Indiana (S4), Iowa (S3), Kansas (S3), Kentucky (S4), Louisiana (S4S5), Maine (S5), Maryland (S5), Massachusetts (S5), Michigan (S4), Minnesota (SNR), Mississippi (S5), Missouri (S4), Navajo Nation (S5), Nebraska (S4), Nevada (S5), New Hampshire (S4S5), New Jersey (S5), New Mexico (S5), New York (S5), North Carolina (S5), North Dakota (SU), Ohio (SNR), Oklahoma (S4), Oregon (S4), Pennsylvania (S5), Rhode Island (S5), South Carolina (SNR), South Dakota (S5), Tennessee (S5), Texas (S5), Utah (S3S4), Vermont (S5), Virginia (S5), West Virginia (S5), Wisconsin (S4S5), Wyoming (S2)

Rank Definitions (Master et al. 2012)

N1/S1: Critically Imperilled: At very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.

S2: Imperilled: At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.

S3: Vulnerable: At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.

S4: Apparently Secure: At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.

S4S5: Secure/Apparently Secure: At no risk to fairly low risk of extirpation in the jurisdiction due to an extensive to very extensive range, abundant populations or occurrences, with little to some concern as a result of local recent declines, threats or other factors.

G5/N5/S5: Secure: At very low risk of extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.

NR: Unranked: Conservation status not yet assessed

U: Unrankable: Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

Appendix B: Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*[30]. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the Federal Sustainable Development Strategy's[31] (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below in this statement.

This recovery strategy will clearly benefit the environment by promoting the recovery of the Grey Fox. The Grey Fox is a generalist species with an omnivorous diet and its functions in the environment include predator, prey and seed disperser. Grey Foxes may compete with similar sized predators, such as Coyotes and Red Foxes, but these species are widespread and abundant within the historic range of the Grey Fox. Grey Foxes prey on a variety of small mammals, especially Eastern Cottontails (*Silvilagus floridanus*) and small rodents (e.g. *Peromyscus* spp., Judge and Haviernick 2002). However, because it does not focus on a particular prey type, and because it does not aggregate in large numbers or reach high densities (e.g. estimated 1.4 individuals/km^2 on Pelee Island, Judge and Haviernick 2002), it is unlikely to have population-level impacts on these abundant and wide-spread prey types. Habitat stewardship of forested habitat on Pelee Island to support the recovery of the Grey Fox is likely to benefit other species at risk found on the island.

The potential for the strategy to inadvertently lead to adverse effects on other species was considered. If new trapping best management practices lead to changes in types of traps used or in trapping practices, this may affect numbers of other animals, especially the numbers of canids (e.g. Coyotes, Red Foxes) captured. This has the potential to affect rates of predation by canids on other animals, as well as rates of interspecific competition, but the consequences of such a change are difficult to predict, and would depend on the number of trappers making changes to their methods. At the present, the recovery actions focus on research into methods of reducing by-catch and development and promotion of best management practices based on this research,

[30] www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1
[31] www.ec.gc.ca/dd-sd/default.asp?lang=En&n=CD30F295-1

which is unlikely to have significant direct impacts on capture rates of other species. However, these potential impacts should be taken into account during changes to trapping methods. Other recovery actions for the Grey Fox focus on communication and outreach, surveys and monitoring, stewardship and research. These activities have very little potential to lead to adverse effects on other species that may share habitat with the Grey Fox. Activities with potential impacts on other species, such as habitat management, are not recommended at this time.

The SEA concluded that this recovery strategy will clearly benefit the environment and will not entail any significant adverse effects. The reader should refer to the following sections of the document in particular: description of the species' habitat and biological needs, ecological role, and limiting factors; effects on other species; and the recommended approaches for recovery.